

CONNECTION TIME FREE DATA MESSAGING THROUGH TELEPHONE NETWORKS

FIELD OF THE INVENTION

The present invention relates to the field of communicating data on land-line or cellular telephone networks.

5 BACKGROUND OF THE INVENTION

Mobile services such as, for example, trucking, courier and delivery services are required to maintain some form of communication channel with their dispatcher in order to receive instructions on the one hand, and to update the dispatcher as to their location and service activities, on the other. Stationary
10 services such as, for example, vending machines, may also require a similar communication channel.

Such communication channels can be realized, for example, using existing telephone networks, both wired and cellular, radio communication equipment and pagers. Customized pagers are particularly popular. Such pagers
15 use short messaging triggers in which each message is compressed to correspond to a given short code. Services having a large fleet of monitored equipment such as vehicles, in the case of mobile equipment, or vending machines, in the case of stationary equipment, can reduce data communication costs by using customized pagers. However, such communication costs can only be minimized but not

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completely eliminated. Similarly, telephone messages can be coded, but again this can only minimize connect time costs, but not eliminate them.

GLOSSARY

5 In the following specification and claims the following terms, some of which are conventional and others which are coined, will be used:

10 ***IN - Intelligent Network*** - A telephone network, land-line or cellular, based on intelligent network switches that generate signalling according to a predefined protocol which enables intelligent filtering of a call, depending on at least its source (caller) and its target (recipient) by generating a "ring" at the called station.

CN - Conventional Network - A telephone network, land-line or cellular, which does not include intelligent network signalling of the switches.

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To Call - to communicate or try to communicate by telephone.

Caller - a communicating party that places a call.

20 ***Beginning-of-Call*** - the earliest event at which a receiver can detect a call.

Clock trigger - a signal during a call procedure taken as a reference point in time from which a duration of the call is measured. For example, any "ring" could be used as a clock trigger, as well as the beginning-of-call as defined above.

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Recipient, Receiver - a communicating party that is called.

Message Code (MSC) - a code specifying in sufficient details (upon decoding) the contents of a specific message.

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Message - any form of information including but not limited by instructions, data and any required combination of words and or numerals.

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Caller Identity Code (IDC) - a code specifying in sufficient details the identification of a message source.

5 **Message Arrival Time (MAT)** - the time at which a receiving party starts to receive a message.

Message Time of Relevance (MTR) - the time of relevance of a message data. That is, the time at which the reported event happened.

10 **Identified Message (IDM)** - a combination of IDC and MSC.

ACKnowledge (ACK) - confirmation of correct receipt by a message recipient.

15 **Not ACKnowledge (NACK)** - recipient signal for a failure in receiving a message.

Partial ACKnowledge (PACK) - recipient signal for a message that was received correctly but not in full.

20 **Active Messaging Party (AMP)** - a party in the communication procedure that has the ability to call the other party for transmitting or receiving data.

25 **Passive Messaging Party (PAP)** - a party in the communication procedure that has the ability to receive and decode messages and to prepare messages for AMP polling, but not to call the other party.

REGistration (REG) - a signal sent by an AMP to any receiver, meaning "I am the current party to the communication and your answers or messages should be addressed to me, and only to me".

30 **Modem or Line Interface (MLI)** - an electronic board which can receive and transmit calls and generate "rings" accordingly, including switching a given line response tone from "free" to "busy" and vice-versa.

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Busy/Free tone generator (B/FTG) - a module, hardware and/or software, which can command a line to switch from "free" to "busy" states or vice-versa. For certain types of MLI the B/FTG can be a pure software module.

- 5 *Polling (POL)* - a procedure activated by an AMP, through which it receives a message even though the other party did not have to generate a single call.

Line - short for cellular or land "telephone line", each line being associated with a telephone number.

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Line index - a number indicative of a telephone line. A line index therefore also corresponds to the telephone number associated with the telephone line.

- 15 *Time-out* - a predetermined time allotted to a caller for transmitting the elements of a message code. If the time-out is exceeded then the message coding (encoding by the sender, decoding by the receiver) procedure is terminated.

Time-out procedure - a procedure for terminating a process after time-out has elapsed.

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SUMMARY OF THE INVENTION

- 25 It is the object of the present invention to provide a method and a system for communicating between two or more communicating parties using telephone networks, in which connection time costs are substantially completely eliminated.

The telephone networks can be land-line or cellular, and the transmission of a call by a caller to a recipient can be via any medium including via satellite.

- 30 The invention, in particular, pertains to the communicating of a code between two communicating parties. The code will generally be either a caller identity code, identifying the caller, or a message code representative of a message. Terms such as, transmitting a code and sending a code will also be employed.

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However, it should be clear that in accordance with the invention a call is never answered.

No message code is transmitted in the generally accepted understanding of the term. That is, no stream of bits containing the message is actually transmitted from the caller to the recipient along a line, requiring the recipient to answer the call in order to receive the message. In accordance with the present invention a call is never answered.

In accordance with the present invention there is provided a method for communicating between a caller and a recipient via telephone networks comprising the steps of:

- (a) the caller placing at least one call from at least one caller telephone line to at least one recipient telephone line;
- (b) the recipient receiving but not answering the at least one call, whereby a code is communicated between the caller and the recipient; and
- (c) determining a message from the communicated code.

In accordance with a first aspect of the invention, the code is communicated by the recipient noting which recipient telephone lines are called and if more than one line is called in which order they are called.

In accordance with a second aspect of the invention, the code is communicated by the recipient noting from which caller telephone lines the at least one call is made and if more than one call is made in which order the calls are made.

In accordance with a third aspect of the invention, the code is communicated by the recipient preparing at least one recipient telephone line in a given state and wherein the caller notes the state of the at least one prepared recipient telephone line.

Generally, the given state of a recipient telephone line is chosen from amongst the group that includes busy and free states.

By one embodiment, the at least one call is received at a first time value and wherein the code is communicated by the recipient noting which recipient telephone lines are called together with the elapsed time between the first time value and disconnection.

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By another embodiment, the at least one call is received at a first time value and wherein the code is communicated by the recipient noting from which caller telephone lines the at least one call is made together with the elapsed time between the first time value and disconnection.

5 Preferably, the first time value is the time at which a clock trigger of the call occurred.

Preferably, the telephone networks are intelligent networks.

Alternatively, the telephone networks are conventional networks.

For intelligent networks, the network provides a caller identity code
10 which is automatically transmitted on communication signals transmitted through the telephone networks when the caller places a call, and which is capable of being automatically decoded from the communication signals.

For conventional networks, the caller, if desired, further provides a caller identity code being provided by the caller calling recipient telephone lines
15 indicative of the caller identity code.

Further in accordance with the present invention there is provided a method for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, the method comprising the following steps:

placing at least one telephone call by a caller, whereby at least one telephone
20 line is called;

receiving at least one telephone call without answering the call by a recipient;
and

relating the at least one call of the caller to recipient called but not answered telephone number to a given code; the code being indicative of an identified
25 message.

Yet further in accordance with the present invention there is provided a method for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, the method comprising the steps of:

placing at least one telephone call by a caller, whereby at least one telephone
30 number is transmitted;

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receiving at least one telephone number by a recipient in response to the transmitted at least one telephone number, without answering the placed at least one telephone call; and

relating the received at least one caller telephone number to a given code; the
5 code being indicative of an identified message.

Still further in accordance with the present invention there is provided a method for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, and wherein a telephone line state determines authorization for continuation of the method for communicating, authorization being
10 given if the telephone line state is in an "authorization-continue" state; the method comprising the steps of:

placing at least one unanswered telephone call by an active caller to at least one passive caller telephone line and upon receiving "authorization-continue" state;

placing a series of at least one unanswered telephone call by the active caller
15 to the at least one passive caller line; and

noting the telephone line states of the series of at least one unanswered telephone call, whereby a series of states indicative of a message code is obtained, the code being indicative of an identified message.

Still yet further in accordance with the present invention there is
20 provided a method for communicating that exploits existing telephone networks, wherein telephone call are placed but not answered, and wherein the time from a first time value till disconnection of the call together with the called line number generates a code-element of a coded message; the method comprising the steps of:

25 placing at least one telephone call by a caller, whereby at least one telephone line is called but not answered;

receiving at least one telephone call without answering the call by a recipient; and noting the time from the first time value till disconnection of the call; and

relating the at least one call of the caller to recipient called but not answered
30 telephone number together with the time noted from the first time value till disconnection to a given code; the code being indicative of an identified message.

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Additionally in accordance with the present invention there is provided a method for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, and wherein the time from a first time value till disconnection of the call together with the calling line number
5 generate a code-element of a coded message; the method comprising the steps of:

placing at least one telephone call by a caller, whereby at least one telephone line is called;

receiving at least one telephone number by a recipient in response to the transmitted at least one telephone number, without answering the placed at least one
10 telephone call; and noting the time from the first time value till disconnection of the call; and

relating the received at least one caller telephone number together with the time noted from the first time value till disconnection to a given code; the code being indicative of an identified message.

15 Preferably, the first time value is the time at which a clock trigger of the call occurred.

In accordance with the present invention there is also provided a system for communicating between a caller and a recipient via telephone networks comprising:

20 (a) means for the caller placing at least one call from at least one caller telephone line to at least one recipient telephone line;

(b) means for the recipient receiving but not answering the at least one call, whereby a code is communicated between the caller and the recipient; and

(c) means for determining a message from the communicated code.

25 In accordance with a first aspect of the invention, the code is communicated by the recipient noting which recipient telephone lines are called and if more than one line is called in which order they are called.

In accordance with a second aspect of the invention, the code is communicated by the recipient noting from which caller telephone lines the at least
30 one call is made and if more than one call is made in which order the calls are made.

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In accordance with a third aspect of the invention, the code is communicated by the recipient preparing at least one recipient telephone line in a given state and wherein the caller notes the state of the at least one prepared recipient telephone line.

5 Generally, the given state of a recipient telephone line is chosen from amongst the group of busy and free states.

 By one embodiment, the at least one call is received at a first time value and wherein the code is communicated by the recipient noting which recipient telephone lines are called together with the elapsed time between the first time
10 value and disconnection.

 By another embodiment, the at least one call is received at a first time value and wherein the code is communicated by the recipient noting from which caller telephone lines the at least one call is made together with the elapsed time between the first time value and disconnection.

15 Preferably, the first time value is the time at which a clock trigger of the call occurred.

 Preferably, the telephone networks are intelligent networks.

 Alternatively, the telephone networks are conventional networks.

 For intelligent networks, the network provides a caller identity code
20 which is automatically transmitted on communication signals transmitted through the telephone networks when the caller places a call, and which is capable of being automatically decoded from the communication signals.

 For conventional networks, the caller, if desired, further provides a caller identity code being provided by the caller calling recipient telephone lines
25 indicative of the caller identity code.

 Further in accordance with the present invention there is provided a system for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, the system comprising:

 means for placing at least one telephone call by a caller, whereby at least one
30 telephone line is called;

 means for receiving at least one telephone call without answering the call by a recipient; and

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means for relating the at least one call of the caller to recipient called but not answered telephone number to a given code; the code being indicative of an identified message.

5 Yet further in accordance with the present invention there is provided a system for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, the system comprising:

means for placing at least one telephone call by a caller, whereby at least one telephone number is transmitted;

10 means for receiving at least one telephone number by a recipient in response to the transmitted at least one telephone number, without answering the placed at least one telephone call; and

means for relating the received at least one caller telephone number to a given code; the code being indicative of an identified message.

15 Still further in accordance with the present invention there is provided a system for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, and wherein a telephone line state determines authorization for continuation of communicating, authorization being given if the telephone line state is in an "authorization-continue" state; the system comprising:

20 means for placing at least one unanswered telephone call by an active caller to at least one passive caller telephone line and upon receiving "authorization--continue" state;

means for placing a series of at least one unanswered telephone call by the active caller to the at least one passive caller line; and

25 means for noting the telephone line states of the series of at least one unanswered telephone call, whereby a series of states indicative of a message code is obtained, the code being indicative of an identified message.

30 Still yet further in accordance with the present invention there is provided a system for communicating that exploits existing telephone networks, wherein telephone call are placed but not answered, and wherein the time from a first time value till disconnection of the call together with the called line number generates a code-element of a coded message; the system comprising:

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means for placing at least one telephone call by a caller, whereby at least one telephone line is called but not answered;

means for receiving at least one telephone call without answering the call by a recipient; and noting the time from the first time value till disconnection of the call; and

means for relating the at least one call of the caller to recipient called but not answered telephone number together with the time noted from the first time value till disconnection to a given code; the code being indicative of an identified message.

10 Additionally in accordance with the present invention there is provided a system for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, and wherein the time from a first time value till disconnection of the call together with the calling line number generate a code-element of a coded message; the system comprising the:

15 means for placing at least one telephone call by a caller, whereby at least one telephone line is called;

 means for receiving at least one telephone number by a recipient in response to the transmitted at least one telephone number, without answering the placed at least one telephone call; and noting the time from the first time value till

20 disconnection of the call; and

 means for relating the received at least one caller telephone number together with the time noted from the first time value till disconnection to a given code; the code being indicative of an identified message.

25 Preferably, the first time value is the time at which a clock trigger of the call occurred.

 An active messaging party is used in the system of the invention for transmitting message codes and a passive messaging party for receiving message codes and for preparing message codes for polling.

30 Devices requiring status reports of at least one state of the device are used in the system of the invention. A typical such device is an automated point of service requiring status reports selected from at least one of the type and quantity of stock and service required for the automated point of service and faults and

failures of the automated point of service that are required to be fixed. Another typical such device is a manned point of service requiring status reports selected from at least one of the type and quantity of stock and service required for the manned point of service and faults and failures of the manned point of service that are required to be fixed.

Devices requiring status reports of values read from the device are also used in the system of the invention. A typical such device is a utility meter.

Also used in a system in accordance with the invention are device commands for applying to a device having a given state. The device command causes a change in the given state. A typical such device command is a controller command for applying to an apparatus having a given state. The controller command causing a change in the given state and the apparatus. Typical examples of such apparatuses are e.g. water valves, traffic lights, electric current switches and smart house controllers.

Today, the ID or LINE number of a given public telephone-network subscriber is based on a unique number of ordered digits. The number of digits of such ID depends (*inter alia*) on the total number of the network subscribers and its expected growth rate. The network operator together with the subscriber community have a clear preference to keep the line-number as short as possible. However, in order to give room for the growth of subscriber community, it is customary to let the number of different possible combinations of line-numbers be at least many tens of percents bigger than the actual number of subscribers. Nevertheless, many operators take into account that their infrastructure should be able to support a major change of the number system, such as adding a digit to current line-numbers in order to give room to an increase of an order of magnitude in subscriber number. Consequently, the infrastructure supporting most intelligent networks today particularly the digital ones can be switched from a given number of line-number-digits to a new one, having one character more, in no time, and the IDC coupled to the new numbers will be transmitted to the receiver with the extra digit(s) automatically. In the context of the invention the location which stores the caller ID (IDC) on the called ID and which further has free room is referred to

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herein as "*extended identification code*" (EIC). The EIC refers to caller telephone number (CEIC) or recipient telephone number (REIC).

Accordingly, in accordance with yet another aspect of the invention (hereinafter "*extended encoding message aspect*") a currently unused portion of the EIC in intelligent networks will be exploited for increasing the repertoire of messages transmitted between caller and recipient whilst obviating the need to increase correspondingly the number of lines that are allocated for transmitting the extended set of messages. According to one embodiment of the invention, at least one character or other value (constituting a code element of a code portion) that resides in the currently unexploited section of the CEIC field (hereinafter "*least significant portion*" (LSP)) is attached to the IDC section and thereby increase the number of messages that may be transmitted.

Consider for example one line linking between the caller and recipient and one free location (constituting the LSP) which may hold the values as 0-9 representative of ten different messages. When the sender appends to the IDC a value from 0 to 9 (depending upon the desired message to be transmitted), the telephone exchange routes the call from the calling end to the receiving end with the code element being transparent to the intelligent network. A suitable device at the receiver's end accesses this specific location and extracts the value stored therein. By inquiring a look up table the message is easily decoded. By this approach, so called "*many-to-one*" infrastructure is emulated by using only one physical line.

The advantage of the proposed scheme resides mainly in its simplicity. The intelligent exchange network will still refer only to the MSP and what remains to be done is for a dedicated device or module to access and extract the relevant LSP and decoding therefrom the desired message.

Whilst the description above illustrates the proposed extended encoded message aspect with respect to one telephone line with the LSP attached to the IDC, those versed in the art will readily appreciate that this is, of course, only one out of many possible variants. Thus, another code element may be an LSP attached to the receiver telephone number (constituting REIC) of the call assuming, of course, that also here there is available a section transparent to the intelligent

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network. Of course if there are x free locations in the EIC and the LSP constitutes y ($y \leq x$) locations, the LSP may be placed at any y location within the x available location.

Thus in its broadest aspect message code may include a succession of elements at least one of which each includes an MSP+LSP where MSP stands for either or both of the called and receiver telephone number and the LSP constituted by one or more free locations. Each location may hold a digit or other code provided that the device that the code may be decoded i.e. it is possible to extract, decode and or obtain therefrom a desired message. As explained above, the elapsed time between the first time value and disconnection may constitute yet another code element of a code portion in order to further increase the repertoire of possible messages transmitted from the caller to recipient. As will be exemplified below, the order of the elements may, if desired, be significant for encoding messages. This scheme, may, if desired, be applicable to more than one line in which one or more telephone lines of the calling telephone lines may constitute a code element (or code elements) and/or one or more telephone lines of the receiving telephone lines may constitute a code element (or code elements), thereby significantly increasing the number of messages without requiring to likewise extend the associated infrastructure.

Within the context of the invention, the encoding of messages may thus use in addition to code portion consisting of at least one code elements being an LSP in the manner specified, other types of code portion such as ringing time, calling telephone line receiving telephone line, and possibly others all as required and appropriate.

The present invention provides thus for a method for sending an encoded message, selected from a set of at least one message, from at least one telephone line of a calling end to at least one telephone line of receiving end in an intelligent telephone network, comprising:

(a) at the calling end, encoding the message so as to include at least a code portion which is transparent to the intelligent telephone network;

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(b) routing the encoded message via at least one call from at least one of said telephone line of the calling end to at least one of said telephone line of the receiving end;

5 (c) at the receiving end, receiving but not answering the at least one call and decoding therefrom the encoded message.

Still further the invention provides for a system for sending an encoded message, selected from a set of at least one message, from at least one telephone line of a calling end to at least one telephone line of receiving end in an intelligent telephone network, comprising:

10 (a) at the calling end, encoder for encoding the message so as to include at least a code portion which is transparent to the intelligent telephone network;

(b) router for routing the encoded message via at least one call from at least one of said telephone line of the calling end to at least one of said telephone line of the receiving end;

15 (c) at the receiving end, receiver for receiving but not answering the at least one call and decoding therefrom the encoded message.

Still further, the invention provides for use in a system of the kind specified:

20 at the calling end, encoder for encoding the message so as to include at least a code portion which is transparent to the intelligent telephone network;

router for routing the encoded message via at least one call from at least one of said telephone line of the calling end to at least one of said telephone line of the receiving end.

The invention further provides use in a system of the kind specified:

25 at the receiving end, receiver for receiving but not answering the at least one call and decoding therefrom the encoded message.

It should be noted that any reference to "*time t*" on time interval " Δt " should be construed in the context of the description and appended claims as encompassing also substantially t and substantially Δt . Thus by way of non limiting example, when referring to the following statement "*the first time value is the time at which a clock trigger of the call occurred*", also encompasses a situation where the first time precedes or is delayed by Δt in respect of said clock trigger event. By

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way of another non limiting example, reference to e.g. *"the elapsed time between the first time (t_1) value and disconnection (t_2) should not be construed, merely as $t_2 - t_1$ but may be construed as encompassing $t_2 \pm \Delta t' - t_1 \pm \Delta t$ "* where $\Delta t'$ and Δt are not necessarily identical.

5 It should be further borne in mind that in the context of the description and appended claims, any reference to *"means plus"* function is not bound to the specific example that is provided in the description but rather encompasses any known *per se* hardware and/or software realization for accomplishing the function.

10 Whilst as will be readily appreciated from the description and the claims, the invention exploits on the concept that transmission of messages do not incur costs, those versed in the art will readily appreciate that the system and method of the invention may be utilized in conjunction with transactions that incur costs, all as required and appropriate.

15 **BRIEF DESCRIPTION OF THE DRAWINGS**

For a better understanding the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is an illustrative block diagram of a communication scenario for the communication of data between two parties;

20 Fig. 2 is an illustrative block diagram of a typical communication scenario wherein data is communicated between an operation center and a number of operating points;

Fig. 3 is an illustrative block diagram showing a caller in communication with a recipient via telephone network;

25 Fig. 4 is a flow chart showing the principal steps of the method of the invention in accordance with a broad aspect of the invention;

Fig. 5 is an illustrative block diagram showing generally the modules of an active messaging party unit in accordance with a preferred embodiment of the invention;

30 Fig. 6 is an illustrative block diagram showing generally the modules of a passive messaging party unit in accordance with a preferred embodiment of the invention;

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Fig. 7 is a flow chart showing the principle steps for caller identity code decoding by a receiver utilizing either intelligent or conventional network operations;

5 Fig. 8 is a flow chart showing the principle steps for caller identity code encoding by a caller utilizing either intelligent or conventional network operations;

Fig. 9 is a flow chart showing the principle steps of the receiver logic of a multi-line receiver for receiving a message code from a single line active messaging party;

10 Fig. 10 is a flow chart showing the principle steps of a single-line active messaging party logic for transmitting a message code to a multi-line receiver;

Fig. 11 is a flow chart showing the principle steps of the receiver logic of a single-line receiver for receiving a message code from a multi-line active messaging party;

15 Fig. 12 is a flow chart showing the principle steps of a multi-line active messaging party logic for transmitting a message code to a single-line receiver;

Fig. 13 is a flow chart showing the principle steps of a multi-line receiver logic for message code poling by a single-line caller;

Fig. 14 is a flow chart showing the principle steps of a single-line caller logic for message code poling from a multi-line receiver;

20 Fig. 15 is a flow chart showing the principle steps of the receiver logic of a single-line receiver for receiving a message code from a multi-line active messaging party; and

Fig. 16 is a flow chart showing the principle steps of a multi-line active messaging party logic for transmitting a message code to a single-line receiver.

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DETAILED DESCRIPTION OF THE INVENTION

Attention is first drawn to Fig. 1 showing an illustrative block diagram of a communication scenario for the communication of data between two parties 10 and 12. The communication medium 14 is a telephone network which can be
30 cellular, wired or a combination of both. The telephone network can be a conventional network or an intelligent network or a combination thereof. Either of the parties may be an operation center or an operating point. Communicating

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parties 10 and 12 may be provided with a plurality of telephone lines, (i.e. they are multi-line systems) or with one telephone line (i.e., they are single-line systems).

In a typical communication scenario shown in Fig. 2, data is communicated between a single operation center 16 and a plurality of operating points 18, of which only three are shown for the sake of simplicity. Preferably, but not necessarily, operation center 16 is a multi-line system and operating points 18 are single-line systems. An operation center is typically, but not necessarily, manned by a dispatcher or service organizer, though it could be a fully automatic computerized system, whereas the operating points could be, for example, vending machines, utility meters, or mobile service personnel required to receive or poll messages from the operation center and to transmit messages to the operation center. Data messaging between two single-line communicating parties is conducted more efficiently over intelligent networks.

In accordance with the present invention, and as will be described in greater detail below, data is communicated between communicating parties such as 10 and 12, or more specifically between operation center 16 and operating points 18, by a first party calling a telephone line, or telephone lines of a second party without the second party actually answering the call. In general, data is communicated by noting which telephone lines were called, or from which telephone lines the calling was made. Data is also communicated by noting the time elapsed from the first telephone "ring" until disconnection. Data is further communicated by noting the states of called lines, since by setting the called lines at "busy" or "free" a binary code is set up.

Although the communication of data is bi-directional, reference will be made in the following to Fig. 3 which shows a caller 20 in communication with a recipient 22 via telephone network 14.

Attention is now drawn to Fig. 4 showing the principal steps of the method of the invention in accordance with a broad aspect of the invention for communicating between caller 20 and recipient 22 via telephone network 14. At step 24 caller 20 places at least one call from at least one caller telephone line to at least one recipient telephone line. At step 26, recipient 22 receives but does not answer the at least one call placed by the caller, whereby a code is communicated

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between the caller and the recipient. At step 28, a message is determined from the communicated message code, e.g. by looking up a look-up table correlating message codes with messages.

5 In accordance with a first aspect of the method of the invention the code is communicated by recipient 22 noting which recipient telephone lines are called by caller 20 without answering the caller placed calls. Furthermore, if the caller places more than one call, the recipient also notes the order in which the recipient lines are called. The communicated code is given by the recipient lines called, taking into consideration the order in which they are called.

10 In order to illustrate the method in accordance with the first aspect of the invention, consider the case in which recipient 22 has ten telephone lines and caller 20 calls recipient telephone lines 2, 5, 9 and in that order. If each of the numbers from 1 to 10 and each combination of the numbers from 1 to 10 is related to a given message code, known to both caller 20 and recipient 22, then by noting
15 that recipient telephones lines 2, 5, 9 were called, and in that order, recipient 22 has received a message from caller 20 via telephone network 14 without having answered the recipient called telephone lines. Another message would be related to the combination 5, 2, 9. Yet another message would be related to the combination 5, 2 and a further message to a single number, say 4.

20 Therefore, messages can be communicated between two communicating parties via a telephone network without requiring placed telephone call to be answered. This basic principle of the invention is also utilized in the other aspects of the invention described below.

In accordance with a second aspect of the method of the invention,
25 relevant for intelligent network operations only, the code is communicated by the recipient noting from which caller telephone lines the recipient lines are called. Furthermore, if the caller places more than one call, the recipient also notes the order in which the calls are made.

30 For example, suppose the caller has ten telephone lines and that the caller places calls from lines 2, 3, 7, 10 and in that order, to the recipient. The recipient notes that recipient's lines were called from caller's lines 2, 3, 7, 10, and that the calls were made in that order. Again, the recipient does not answer the

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placed calls. Hence, by noting from which caller's lines the calls were made, and which order, a message has been communicated between caller 20 and recipient 22 via telephone network 14 without recipient answering the placed calls.

5 In accordance with a third aspect of the method of the invention, to the steps shown in Fig. 4 is added the further step of the recipient preparing at least one recipient telephone line in either a line-busy or a line-free state. For example, let there be five recipient lines and denote by "0" a line-busy state and by "1" a line-free state. Let the first, second, third, fourth and fifth recipient lines be set at 0, 1, 1, 0, 1, respectively. The caller calls the recipient lines, starting from line
10 one and ending with line five, and notes the state of each line. In this way the caller polls the code 0, 1, 1, 0, 1 from the recipient. A message is then determined from the polled code by relating the code to an *a priori* known message. It should be noted that using a "line-busy", "line-free" code is equivalent to communicating through a binary code.

15 Noting caller or recipient telephone lines or the state of recipient telephone lines are not the only ways in which data can be communicated between two communicating parties via telephone networks without answering telephone call. Another possibility is for the recipient to count the number of rings from the first ring until disconnection of a caller's telephone call. However, this approach
20 is less robust since the number of rings transmitted by the caller is not always equal to the number of rings received by the recipient. Instead, and in accordance with a fourth aspect of the method of the invention, a code is communicated by the recipient noting which recipient telephone lines are called together with the elapsed time between a clock trigger and disconnection.

25 Similarly, and in accordance with a fifth aspect of the method of the invention a code is communicated by the recipient noting from which caller telephone line calls are made together with the elapsed time between a clock trigger and disconnection.

30 Figs. 5 to 14, to be described below, demonstrate a number of specific embodiments of modules and methods of the invention. Those versed in the art will readily realize that the invention is not bound by the specific embodiments

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illustrated in the figures and that modifications of these specific embodiments also fall within the scope of the invention.

Attention is now drawn to Fig. 5 showing an illustrative block diagram of the essential modules of an active messaging party unit 50 in accordance with a preferred embodiment of the invention.

Central processing unit 52 is a message code generator (i.e., it is an encoder). In most cases 52 operates as an interpreter transforming a message into an ordered list of telephone numbers to be dialed serially by Communication Controller 54 which utilizes at least one modem or line interface 56 connected to an associated line. It should be noted that a single modem or line interface is fully sufficient for the active messaging party unit's operation including the polling of a message from a passive messaging party. However, several modem or line interface's, each connected to its associated line, makes the active messaging party unit's operation more efficient, particularly when it is used as a receiver as well as a transmitter.

Intelligent Network-Data-Decoder 58 (relevant only for Intelligent Network operations) demodulates the caller identity code and message arrival time data, modulated by the network operator at the network switches, usually, but not necessarily, between the first and second rings, and transfers them both to communication controller 54 that filters out "*illegal calling lines*", that is, calling telephone numbers not registered as participating members of the connection-time free coding system. It should be noted that in the case of digital networks, the intelligent network data is decoded according to a data protocol used by the digital network. Caller identity code / message code decoder 60 constructs the caller identity code (for CN operations only) and the incoming message code and transfer them to the IDM analyzer 62 (a processor) which gives the incoming message its full meaning, consisting of the message source and the message contents. The message code, both for incoming and outgoing messages, is preferably constructed from the most significant message element to the least significant message element. Utilizing this feature, a partial message can be decoded even when the messaging procedure has not been fully completed.

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Passive messaging party polling controller 64 operates in conjunction with communication controller 54 to call a passive messaging party line by line to poll a specially prepared message.

Modules 52 through 64 define a pure active messaging party architecture. Several extra lines, comprising collectively a queuing module and collectively designated by the reference numeral 70 are used for queuing callers in order to avoid mixing of messaging procedures. It should be noted that each of the extra lines is coupled to a "busy"/"free" tone generator enabling communication controller 54 to change the line's state from "free" to "busy" and vice-versa.

It should be noted that queuing module 70 is not essential if active messaging party unit 50 does not operate under any circumstances as a polled party in an intelligent network sharing the polled lines with standard data lines. The queuing module is also not essential in intelligent or conventional network operations when the active messaging party receives messages from a single communicating party (typically an operation center). When messaging party unit 50 does play the role of a standard multiple-line receiver, then queuing module 70 is always required when operating in conjunction with a conventional network. When operating in conjunction with an intelligent network queuing module 70 is required for acknowledgment and polling purposes only. The use and operation of the extra lines comprising queuing module 70 will be described in detail with reference to specific applications. A brief description of the principle function of each line is given below.

Queuing module 70 comprises a message-registration line 72, an acknowledge-registration line 74, an answer-line 76 and a polling-registration line 78. The first line to be called by a caller, utilizing conventional network operations, is message-registration line 72. If the line is "free" then the caller can proceed with a desired messaging procedure, whereas if the line is "busy", then the caller is unauthorized to continue with the messaging procedure and should re-call message-registration line 72 until it is "free".

Polling-registration line 78 is for identifying the caller and signaling the receiver to prepare a message code relevant to the specific caller. It also blocks

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access for other con-current callers, through switching both message-registration line 72 and polling-registration line 78 to "busy".

Answer-line 76 is used to check if there is a message waiting for the caller. If there is a message waiting then answer-line 76 will be set to "busy",
5 following the caller's interrogation of the registration line.

Acknowledge-registration line 74 can be used for finalizing the messaging procedure by a request for an acknowledgment from the receiver, verifying that a correct message code has been received.

Attention is now drawn to Fig. 6 showing an illustrative block diagram
10 of the essential modules of a passive messaging party unit 80 in accordance with a preferred embodiment of the invention.

Combined central processing unit and non-volatile memory 82 decodes received message codes, and encodes messages for polling by an active messaging party. Message decoding is conducted utilizing a plurality of data lines 84 (N lines
15 are shown in the figure) each connected to a modem or line interface 86 connected in turn to an associated line. Each of the data lines 84 is coupled to a "busy"/"free" tone generator enabling central processing unit 82 to change the line's state from "free" to "busy" and vice-versa. It is emphasized that the "busy"/"free" tone generators are required only if the receiver is to be polled. Data lines 84 are called
20 serially by an active messaging party. Preferably, the first line called is the most significant element code and the last line called is the least significant element of the code. For conventional network operations, the prefix of the code is the caller's identity code, while for intelligent network operations, the calls made by the active messaging party encode the message code only.

25 Queuing module 90 comprises a message-registration line 92, an acknowledge-registration line 94, an answer-line 96 and a polling-registration line 98. Queuing module 90 is used for queuing callers in order to avoid mixing of messaging procedures. Each of the lines 92, 94, 96 and 98 is coupled to a "busy"/"free" tone generator enabling central processing unit 82 to change each one
30 of the lines state's from "free" to "busy" and vice-versa. Lines 92, 94, 96 and 98 are further coupled to modem or line interfaces 102, 104, 106 and 108, respectively. The basic operation of lines 92, 94, 96 and 98 is identical to the basic

operation of lines 72, 74, 76 and 78 and its description will therefore not be repeated. However, it should be noted that the message code registration line is not used for intelligent network operations and the acknowledge registration and answer registration lines are used only if the receiver is a passive messaging party.

- 5 The polling registration line and the "busy"/"free" tone generators coupled to the N data lines 84 are only used for polling operations.

Intelligent network-data-decoder 110 is utilized in the case of intelligent network operations for extracting the caller identity code and message arrival time data, through demodulation or protocol decoding for digital networks, enabling
10 on-line identification of the caller at each line called, and consequently several incoming message codes can be received and decoded simultaneously.

Passive messaging parties, or an operation center acting mostly as a receiver of calls made by active messaging parties, are normally based on a multiple-line configuration where the number of lines per passive messaging party
15 is based on the principle "*THE MORE THE BETTER*". More lines means greater flexibility in data transceiving procedures and/or shorter transceiving time per message. It should be noted that an active messaging party unit acting as a receiver can be based on the same architecture as that of a passive messaging part such as that shown in Fig. 6.

20 Caller identification is essential as a first stage of any message code decoding. An active messaging party transmitting to a receiver must identify itself to the receiver, and an active messaging party polling a message from another party, must identify itself, so that the other party can prepare a specific message for the current caller.

25 When communication is via an intelligent network the caller identity code and the message arrival time are normally modulated on the carrier frequency of the communication signal transmitted through the telephone network, usually between the first and second incoming rings, and are directly extracted by a modem or line interface connected to the receiver line called by the caller. Digital
30 networks such as ISDN, for example, transmit the caller identity code as part of the "*hand shake*" communication protocol between the caller and the recipient. A modem or line interface can be either a suitable modem or an electronic board

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tailored to extract the caller identity code and the message arrival time through demodulation.

When communication is via a conventional network based on more than one potential caller, the caller identity code is coded as a prefix to the message code. The encoding of a caller identity code is based on a series of calls to the receiver incoming lines. A caller identity code can be encoded by any pre-defined basis.

The caller identity code is given by the order in which the incoming lines are called. Assume, for example, that a receiver has ten incoming lines, denoted receiver lines 1 to 10. Assume also that a caller with caller identity code 1707 calls the receiver. In order for the caller to be identified, the caller will call receiver line-1, then disconnect, then receiver line-7, then disconnect, then receiver line-10, then disconnect, and finally receiver line-7.

A receiver having only 10 lines, as in the above given example, can distinguish between up to 9 callers using one call for the caller identity code, or between up to 99, 999, 9999 callers using 2, 3, 4 calls for the caller identity code, respectively.

However, a receiver having 100 lines can distinguish between up to 99, 9999, 999999, 99999999 callers using 1, 2, 3, 4 calls for the identity caller code, respectively.

In order to avoid interference between several callers trying to transceive data to/from the same source within overlapping periods for conventional network operations, the identity caller code encoding procedure must be preceded by calling the message code registration line, in the case of sending a message, or the polling-registration line, in the case of polling a message. These two lines will be referred to collectively as registration lines, unless clarification is required as to which of the two lines is involved.

If the registration line is "free", then the caller is authorized to proceed with the caller identity code encoding procedure, and the receiver registration line will be switched to "busy" allowing the caller to continue after completion of the caller identity code encoding procedure with a messaging (or polling) procedure without another caller calling at the same time and interfering with the messaging

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procedure. If, on the other hand, the registration line is "busy", then the caller is unauthorized to perform a messaging (or polling) procedure and the caller has to continue calling the registration line until it is "free". Thus, a registration line, whether it be a message code registration line or a polling registration line, enforces "queuing" on asynchronous callers.

Clearly, the use of a caller identity code is imperative for smooth functioning of a messaging (or polling) procedure in practical scenarios wherein several calling parties exist. Therefore both caller identity code decoding and encoding procedures will be described in detail.

Attention is first drawn to Fig. 7 showing a flow chart for caller identity code decoding by a receiver utilizing either intelligent or conventional network operations. If, 200, intelligent network operations are used then at step 202 the received intelligent network data is decoded by demodulation of the incoming call. For digital networks the received intelligent network data is decoded according to a data protocol used by the digital network. At step 204 the caller identity code and message arrival time are generated from the decoded data. The identity code decoding procedure for an intelligent network is now complete and step 206 message decoding or encoding can begin, as required.

If, 200, conventional network operations are used then at step 208 a registration line (either a message-registration line or a polling-registration line) is called. Upon one of the registration lines receiving a call a "busy"/"free" tone generator switches the registration line to "busy", 212. It is pointed out that if the multi-line receiver uses the same group of data lines for both receiving a message and for the polling procedure, then upon starting either a messaging or polling procedure both the message registration and the polling registration lines should be switched to "busy" until completion of the particular procedure. However, if the receiver uses two separate groups of data lines, one for a messaging procedure and one for a polling procedure, then the queues for the two procedures are non-overlapping and separate, and only the registration line related to the particular procedure in question need be called and set to "busy".

At step 214 the "TIME-OUT" procedure is turned on. Step 216 is a declaration that a caller identity code comprising LI elements is to be decoded element by

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element. At step 218 the code element index i is set to zero. Steps 220 to 230 define a loop in which the identity code elements are received. At step 220 the code element index i is increased by 1 and at step 222 a check for "TIME-OUT" is made. If "TIME-OUT" is reached then at step 224 the identity code decoding procedure is terminated and the relevant registration lines (message code and/or polling) are set to "free". If "TIME-OUT" is not reached then at step 226 the n th receiver line rings. If time measurement is used then the period of ringing TR_i until disconnection is noted. At step 228 the i th element of the caller identity code is decoded from a data base. If time measurement is used then the i th element of the caller identity code is given by the combination ni and TR_i . If time measurement is not used then the i th element of the caller identity code is given by ni . At step 230 a check is made to see if the last element ($i = LI$) of the caller identity code has been reached. If the last element has not been reached then control is transferred to step 220 and the next receiver line is called. If, on the other hand, the last element has been reached, then at step 232 the complete caller identity code is ready and can be decoded. The identity code decoding procedure for a conventional network is now complete and step 206 message decoding or encoding can begin, as required.

Attention is now drawn to Fig. 8 showing a flow chart for caller identity code encoding by a caller utilizing either intelligent or conventional network operations. If, at 300, intelligent network operations are used then caller identity code encoding is intrinsic and no further action is required. In this case the caller identity code is modulated on the carrier frequency of the communication signal transmitted through the telephone network. For digital networks the transmitted intelligent network data is encoded according to a data protocol used by the digital network. Control is then transferred out of the caller identity code encoding process at step 302 to another process which could be message code encoding or decoding.

If, at 300, conventional network operations are used then from step 304 transfer is controlled either to polling registration, steps 306 to 310, or to message code registration, steps 312 to 316. Although this is not an integral part of identity code encoding, it is clear that when calling a receiver the caller is calling for a

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reason, and therefor as far as the receiver logic is concerned, reception of a caller identity code should be preceded by appropriate registration so that the receiver knows how to continue after receiving the caller's identity code. After successful registration, caller waits T secs., or K rings, and disconnects. Successful
5 registration is achieved if the registration lines are "free". After the caller has successfully registered with the receiver at step 318, the "TIME-OUT" procedure is turned on at step 320.

At step 322 the caller prepares the identity code to be encoded. This is done by defining a series of receiver lines to be called (LI , say) and, if time
10 measurement is used, assigning to each line to be called a ringing period TR in accordance with a coding conversion table. It is emphasized that measurement of the ringing period is optional and when used adds an additional degree of freedom in building the message code. Caller identity codes are preferably, but not necessarily, built with the first code - element being the most significant and the
15 last code - element being the least significant. This approach ensures that if the end of the caller identity code is not communicated for some reason or other, then the receiver can at least know which caller called from within a group of callers all having the same code beginning.

At step 324 the code element index i is set to zero. Steps 326 to 340
20 define a loop in which the caller identity code elements are encoded. At step 326 the code element index i is increased by 1 and at step 328 a check for "TIME-OUT" is made. If "TIME-OUT" is reached then at step 330 the caller identity code encoding procedure is terminated and caller disconnects and begins the encoding procedure from the beginning (step 304). If "TIME-OUT" is not reached then at
25 step 332 the n th receiver line is called. If the n th receiver line is "busy" then at step 336 the caller disconnects and waits TB secs. before again calling the n th receiver line. If the n th receiver line is "free" then at step 338 the caller waits K rings, or TR_i secs before disconnecting. It should be noted that if time measurement is not used then on calling each receiver line, the caller would wait an
30 identical time period (say T secs.) for each receiver line called and reached. At step 340 a check is made to see if the last element ($i = LI$) of the caller identity code has been encoded. If the last element has not been encoded then control is

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transferred to step 326 and the next receiver line is called in accordance with the caller identity code. If, on the other hand, the last element has been encoded, then at step 342 the complete caller identity code has been encoded. The caller identity code encoding procedure for a conventional network is now complete and at step 5 342 message encoding or decoding can begin, as required.

Once a caller identity code has been received and confirmed a message code sent by a caller can be received. It is important that message codes have well defined structures. In the following, basic concepts concerning the structure of message codes will be described.

10 Message codes are preferably, but not necessarily, built with the first code - element being the most significant and the last code - element being the least significant. This approach assures if the end of the message is lost then at least the important part of the message has been received. In accordance with this approach if related data is to be added to the basic message, it should suffix the message 15 code.

A message code is related to a message through a data-base that relates specific telephone lines (i.e., specific line indices) to numbers, words, messages or combinations thereof. A message code can have any number of elements, defined in the data-base by the first (most-significant) element.

20 Preferably, a "*code - structure*" comprising "*groups*" and "*sub-groups*" should be constructed enabling each successive sub-group of the code, starting with the first element, to have a "*decodable*" and usable meaning.

Message code receiving and transmitting by connection time free data messaging will be illustrated in the following using examples based on commercial 25 applications. In accordance with the invention, in all the examples, calls are placed but not answered. That is, use of the word "*call*" refers to a "*connection-time free call*". Furthermore, in the following examples a slash "/" will be used to denote options. For example A/B/C, denotes either A, or B or C.

The first example is for connection time free receiving/transmitting of 30 message codes from/to fully/semi automated point-of-service (for example, a vending machine). Four different cases will be considered. The following assumptions are made:

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(a) an automated point of service smart controller can sense and distinguish between NE events which may indicate either a technical failure in one of its sub-systems or a need to refill the stock kept on-site.

(b) an operation center, controlling NA (number) points of service (or, points of sale), utilizes NO data lines, preferably of intelligent network operations, for receiving/transmitting data, excluding message registration lines, acknowledge registration lines, answer-lines and polling-registration line .

(c) Three typical messages will be considered:

(i) Power failure.

(ii) Vending machine - motor of the l th product column (out of NC, e.g. 16) is stuck.

(iii) The automated point of service should be refilled with product combination and quantities j (out of NQ, e.g., 128).

Case-1 : The operation center utilizes NO=25 data lines to report NE events (NE < 26), some of which may have related data.

In this case (i.e., for intelligent network operations) message (i) will require a single call to one of the 25 data lines. However, message (ii) will require two calls, the first specifying the failure and the second specifying the vending machine - motor number). Message (iii) will require three calls, the first specifying a refill demand, and the next two specifying the refill combination and quantities j , using the 25-basis coding (i.e., 25 lines or an integer number thereof), where the first out the two element code has a partial meaning.

Thus, it is clearly understood that although message codes for messages (i) and (ii) are based on a code having more than a single element (i.e., more than a single call) they do have a well defined meaning even after the messaging is interrupted after the first element was received.

Case-2 : The operation center utilizes NO=200 lines to report NE (NE < 26) major events, some of which have k combinations of related data, but the summation of the total number of possible combinations NP justifies NP < 200.

In this case, all three messages (i), (ii) and (iii) will require only a single call, sent from the automated point of sale to the operation center.

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Case-3 : The operation center utilizing 25/200 lines (as an intelligent network active messaging party) needs to switch the automated point of sale parameter configuration i to configuration j .

In this case, when $NO=25$, a single call is needed to switch the parameter configuration if less than 25 configuration options are available. However, 2 calls will be needed if more than 25 configuration options are available. When $NO=200$, a single call is needed for precise switching of the parameter option even when the total number of configurations options is 200.

Case-4 : The operation center of the former example is a passive messaging party. Retrieving the parameter option needed for precise operation of the automated point of sale through polling will require 4 or 5 or 6 calls from the active messaging party to the passive messaging party, for 7 or 15 or 31 configuration options, respectively.

The second example is for connection time free receiving/transmitting of message codes from/to a mobile monitored service unit, such as a mobile service fleet unit. Three different cases will be considered. In this example messages received by the mobile monitored service unit contain two forms of instructions. The first is for directing the service unit to a specified location (out of a data base of NA locations, i.e., points of service) and the other is for performing a specified task (out of a list of NT tasks).

Each task has NR reporting mile-stones, which may be accompanied by a location measurement using a global positioning system (the location being determined to within an accuracy of AC) for determining the location of the service unit within a pre-defined marked area AR. Reporting the service unit location together with its status, at a given communication frequency is a legitimate message code in this application.

Case-1 : An operation center controls $NA=200/20,000$ points of service which may require one of $NT=10$ different types of tasks. The operation center utilizes $NO=25/200$ data lines, and has to send a work order to a mobile service unit, specifying the point of service location, the tasks and the order in which the tasks are performed within a daily route based on 20 different service locations.

If $NO=25$ and $NA=200/20,000$ the operation center will have to place 3/4 calls, respectively, to transmit the message code. The first 2/3 calls will be used together to specify the service location and task, utilizing a 25-basis code, and the last call will define the order of the task along the daily route. If $NO=200$,
5 instead of 25, only 2/3 calls will be required, respectively, to transmit the message code, where 1/2 calls, respectively, will be used to specify the service location and task, and the last call will define the order of the task along the daily route.

Case-2 : A mobile service unit (one out of $NU=150$), communicating with the operation center of *Case-1*, needs to report a mile-stone j (out of $NR=5$)
10 of task i (one out of 20 locations) without/with location details having an accuracy of $AC=1.5$ km or 0.15 km, if relevant, within an area of $150*150$ sq km (for intelligent network operations).

If $NO=25$ and $AC = \text{null}/1.5 \text{ km}/0.15 \text{ km}$, (null means that no location is required) the mobile service unit will require 1/4/6 calls, respectively, for each
15 message code. If, instead of $NO=25$, an $NO=200$ line operation center is utilized, then the mobile service unit will require only 1/3/4 calls, respectively.

The first call, or first message code element, in both cases is devoted to NT and NR, where the first mile-stone is reported by calling one of NT (20 in this case) specific lines, while the remaining NR-1 mile-stones which follow the
20 first, utilize another (NR-1) lines, which in this case is 4. Any following calls, are used for reporting the mobile service unit's location. Each call indicates a geographical region. Geographical regions can be marked out using series of squares, termed primary squares. These squares can then be divided into smaller squares, termed secondary squares, and in turn each secondary square can be
25 divided into still smaller squares. Each line called corresponds to a given square.

A first call would indicate that the mobile service unit is located somewhere within the primary square corresponding to the line called. If the resolution of a primary square suffices then no further calls are required. If the accuracy of a secondary square is required then a second call is placed indicating
30 that the mobile service unit is located somewhere within the secondary square corresponding to the line called. The procedure can be continued, depending on the accuracy required.

Case-3 : This is the same as *Case-2* , but the system utilizes conventional network operation. In this case the message code has to be preceded by a call, or calls, giving the caller identity code. Hence, 1/2 calls have to be added to the number of calls given in *Case-2* for NO=25/200 lines, respectively.

5 The third example is for connection time free receiving/transmitting of message codes from/to a person who wishes to call and/or pay for a service or a product supplied by a server. The latter is equipped with a connection time free transceiver and the relevant message decoding and encoding software. This example is applicable e.g. for a motorist wishing to "check in"/"out" to/of "on" or "off-
10 street" parking, or receive a service, such as car wash, or pay for gas products in a gas station, or any telephone user who wishes to purchase a well defined product or service from either a vending machine or a delivery service. Other applications are, of course, applicable, all as required and appropriate. The entire group of the following examples will be referred to as electronic transactions, and the cost of the
15 transaction will be part of the messaging process. In other words this example concerns cost-related messages. Of course, the cost-related messages that are embraced by the invention are not bound to these particular examples. Two different cases will be considered. The following assumptions are made:

- 20 (a) An automated point of service or vending smart controller can sense and distinguish between NE events which may indicate either a request of identified purchaser for a well defined products/services or the event may indicate only a request of identified purchaser to purchase while the selection of the product or service is conducted by signalling the machine the exact selection, e.g. pressing a marked key.
- 25 (b) An operation center, controlling NA (number) points of service (or, points of sale), utilizes NO data lines, preferably of intelligent network operations, for receiving and transmitting data, excluding acknowledge lines.
- (c) A manned user of the system can call for a service/a product utilizing one of the following alternative modes:
 - 30 - if the message is a single element code and no time dependence is related to the decoding - then the user of system does not necessarily use a dedicated terminal but rather utilize a telephone (cellular or wire

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line) owned by him/her and follow the instruction "to purchase a service/product (name) from this vender call number ##### and disconnect"

- if the message is a multi element code (or time dependent code) a dedicated terminal connected to the wire line or cellular device should be used, preferably instructing the user, e.g. using menus, how to select the order.

(d) Three typical messages will be considered:

- (i) Request to purchase a single item (out of NP services or products, predefined by the supplier) - which means that the costs of the transaction is well defined by the message code,
- (ii) Request to purchase an unknown quantity of a well defined product (e.g. "fill my tank", or "I am starting a parking session for unknown period of time"), which means that the costs of the transaction will be defined upon the completion of the purchase.
- (iii) Request to purchase the following "shopping list" (out of a predefined detailed menu), which means that the costs of the transactions can be defined before delivery, but should be accumulated by analyzing the list contents.

Case - 1 : The operation center utilizes NO > > NP data lines to control the transactions related to NP different products or services. In this case message (i) will require a single call to one of the data lines. However, message (ii) will require either two calls, one to start the purchase or service procedure and another one to end it. Alternatively in this case instead of calling to end the sale, the user can, sometime, halt it manually allowing the smart controller "on site" to sense the stop signal. (The "end of process" message may be more relevant to electronic transactions such as parking, while the "stop" key may be more relevant to electronic transactions such as gas refueling). Message (iii) may require any number of calls starting from one when NP is small (=2-3). As the series of calls become very long, the efficiency of the procedure decreases significantly.

In all three message types the last element code of the message has a double meaning - a) supply the products/services to the caller and - b) receive the

price for the transaction, as agreed in advance for messages (i) and (iii) and upon completion of the transaction for message (ii). Such price can be charged through billing files defining by each transaction, and supplied for collection to the public network operator providing the communication services to the identified caller or to billing entities as agreed between the parties (for example, credit card companies).

Case - 2 : The receiving party utilizes $NO=1$ data lines to control $NP>1$. In this case message (i) may require more than a single call to the data line, unless the caller after placing the message will indicate by another means, i.e., pressing a key on a vending machine, the i.d. of the product or service selected. As a result the most significant portion of the message will define the request to make an electronic transaction paid by the caller, and the least significant part, defined by the pressed key will identify the requested product or service and their value. Message (ii), utilizing the same mechanism, will require either two calls, one to start the purchase or service procedure and another one to end it. Alternatively in this case instead of calling to end the sale, the user can, sometime, halt it manually allowing the smart controller "on site" to sense the stop signal. (The "end of process" message may be more relevant to electronic transactions such as parking, while the "stop" key may be more relevant to electronic transactions such as gas refueling). Message (iii) in this case cannot be communicated efficiently.

Having described the basic concepts concerning the structure of message codes, messaging procedures for connection time free receiving/transmitting of message codes will be described.

Three basic messaging procedures will be described: (i) a single-line caller calling a multi-line recipient, (ii) a multi-line caller calling a single-line recipient and, (iii) a single-line caller polling a multi-line recipient. For each procedure specific examples will be given for both the caller logic and the receiver logic along with flow charts illustrating general messaging procedures for each of these cases.

It should be noted that multi-line to single-line, single-line to multi-line and single-line to single-line messaging procedures are special cases of multi-line to multi-line messaging procedures. Since a service point should be as inexpensive

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as possible, whereas an operation center should be efficient, service points are generally single-line and operation centers are generally multi-line, and therefore the three basic messaging procedures to be described are important cases.

5 Consideration will first be given to a single line active messaging party transmitting a message to a multi-line receiver.

For intelligent network operations each call is independently identified and therefore the messaging procedure can support many callers (active messaging parties) initiating data transmittals during overlapping transmission periods. A message code sent by an active messaging party is a code, built as a series of
10 receiver incoming line numbers preferably ordered from the "most" to the "least" significant element of the code, where each "element" of the code corresponds to the line index, i , of the receiver line called.

Message code encoding and decoding procedures are based on the following assumptions:

15 (a1) The communicating parties have at their disposal a pre-defined data base of MM messages and associated message codes.

(a2) The receiving party utilizes N lines for receiving message codes, each line being characterized by a line index i .

(a3) The relations between MM and N together with optimal coding considerations requires a message code to be based on MI elements, where the first element
20 is, preferably, the "most" significant element and the MIth is the "least" significant element. For example, if MM = 9 or 99 and N = 10, then MI = 1 or 2, respectively. Similarly, if MM = 99 or 9999 and N = 100, then MI = 1 or 2, respectively.

25 (a4) Each caller has a pre-defined time (TIME-OUT) to transmit its MI element message code from the moment the caller reaches the called line representing the "most" significant element of the message code and finds the called line in a "free" state.

(a5) The messaging procedure can be finalized by a request for an acknowledgment
30 from the receiver, verifying that a correct message code has been received. Such acknowledgment is accomplished in one of two ways depending on the nature of the receiver.

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If the receiver is a passive messaging party, then messaging procedure has to be preceded by caller registration, which is performed by the caller calling the passive messaging party's acknowledge registration line informing the passive message party that the caller is interested in receiving an acknowledgement for its message. If the acknowledge registration line is "*busy*" then the caller should
5 continue calling until it is "*free*". After registration an acknowledge, not acknowledge or partial acknowledge message code will be waiting for the caller through the "*busy*"/"*free*" states of the passive messaging party's answer line.

If, however, the receiver is an active messaging party it can send a
10 relevant message code to the caller regarding the messaging procedure success.

(a6) Intelligent structuring of the message code data-base together with the fact that the encoding procedure is based on serial data transmittals from "most" to "least" significant element, enable retrieving partial messages even when the procedure is discontinued for any reason before completion. Examples demonstrat-
15 ing the importance of partial messages to the robustness of the application will be given later. A partial message can be extracted from a code where each element marks a sub-group of the former element.

For conventional network operations the message sent by an active messaging party must be preceded the identity code serial encoding procedure described above. Therefore, only one active messaging party can communicate
20 with a given passive messaging party at a time.

During the entire procedure, starting from caller identification, through messaging and till final receipt of an acknowledge, not acknowledge or partial acknowledge message code, or termination of the procedure due to "*time-out*", the message code registration line must be in the "*busy*" state, denoting that the passive
25 messaging party is occupied and cannot receive new messages from a different caller. On completion of the procedure due to "*time-out*" termination or due to completion of the acknowledge procedure the message registration line is switched to the "*free*" state and the receiver is ready for receiving a new message code.
30 Even when the receiver is an active messaging party the acknowledge line should be interrogated by the caller so that the identity code formerly established will not be lost. This is in complete contrast to the case of intelligent network operation,

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where the caller identity code is modulated on the carrier frequency of the communication signal.

Due to the structure of conventional network operation, which can not tolerate several callers trying to transceive data to/from the same receiver within overlapping periods, it is sometimes more efficient to sub-divide the NO receiver lines to n sub-groups, each sub-group operating as an independent receiver, and consequently, n message codes can be transceived in parallel. For example, the efficiency of a 100-line conventional network receiver, after sub-division of its lines to 10 independent groups, is about a factor of five to six times higher as compared to a single 100-line system. Namely, it can receive five times more calls per time unit.

The procedure for a single-line active messaging party transmitting a message to a multi-line receiver is summarized in Figs. 9 and 10, which will now be described. The following notation will be used in these two figures:

MM denotes the total number of message codes used,
MI denotes the number of elements in a message code.
N denotes the total number of receiver indexed lines,
 i, j indices of message code elements,
 $n_i (n_j)$ index of the i th (j th) receiver indexed line,
OM denotes the number of different element code values = $N \cdot TV$, where
TV denotes the number of possible time values (rounded off) measured from a clock trigger till disconnection.

A comparison of time-dependent messaging and time-independent messaging and the influence of time measurement on the number of message codes obtainable will now be illustrated. Consider a single line active messaging party that transmits a message to, or receives a message from, a 10-line multiple-line communicating party, and let $TV=4$. Then each call represents 1 out of 40 message code element values, instead of 10 values when the coding procedure does not use time-dependent message code element values (i.e., the coding procedure ignores the time duration from first "ring" to disconnection). Correspondingly, a time dependent message code, based on 2 or 3 code elements, will generate an arsenal of 1600 or 64000 different message codes as compared to only 100 or 1000

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different message codes, respectively, when the coding procedure does not use time-dependent message code element values.

Attention is first drawn to Fig. 9 showing the principle steps of the receiver logic of a multi-line receiver for receiving a message code from a single line active messaging party. At step 400 a message code is received by the multi-line receiver from a single-line messaging party. MM is the total number of message codes used, and OM is the number of different element code values. If, at 402, $MM < OM$ (i.e., a single code element defines the message) then control is transferred to step 448. Step 450 distinguishes between two cases. If the total number of message codes used (MM) is less than the number of receiver indexed lines (N) then, in addition to the line index n_i of the line called, measurement of the ringing period TR_i , for line n_i , is required in order to define the message code (steps 456 and 458). If on the other hand, $MM > N$ then the line index n_i of the line called suffices to define the message code (step 452). At step 454 the caller identity code, the message code and message arrival time are defined. Control is then transferred to step 430 which was described above.

If, at 402, $MM > OM$ (a number of calls is required in order to communicate a message call) then at step 404 the received message code is built element-by-element from the first element to the M_i th element. Preferably, but not necessarily, the first element is the most significant element of the message code and the M_i th element is the least significant element.

At step 406 a "time-out" procedure is initialized and at step 410 the message code element index j is initially set to zero. The incoming message code is built in the loop defined by the steps 410 through 418, where the j th element of the message code is given by n_j and TR_j . It should be noted that if time measurement is not used then the j th element of the message code is given by n_j only. The loop ends at step 418 as soon as all the message code elements have been received, assuming that "time-out" was not registered during the process. It is assumed that the receiver knows how many code elements to expect. This can be achieved in a number of ways. For example, it can be agreed upon in advance that the first element received also indicates the total number of elements that the receiver can expect to receive. In accordance with this approach the total number

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of elements that the receiver can expect to receive is given by $MI(n1)$, where $n1$ is index of the first receiver line called.

At step 420 the message code is decoded by comparing the message code elements received with a conversion table that associates message code elements with messages or parts thereof and the caller is identified with the message by noting the callers identity code and the message arrival time.

If at step 412 "time-out" terminated the procedure before all the code elements were received, then there arise two possibilities regarding the number of code elements received. These two possibilities are checked at step 422. If at least one code element was received (i.e., $j > 1$), then at steps 424 and 426 a partial message is determined from the received message code elements, the caller is identified with the partial message by noting the callers identity code and the message arrival time and a partial acknowledge message code is prepared. If on the other hand no message code element was received (i.e., $j < 1$), then at step 428 a not acknowledge message code is prepared.

If the multi-line receiver is an active messaging party then at step 430 control is transferred to step 431 and the multi-line receiver sends an appropriate acknowledge message code (i.e., acknowledge, not acknowledge or partial acknowledge) to the single-line caller. If on the other hand, the multi-line receiver is not an active messaging party, then the single-line caller (who is an active messaging party) has to obtain the state of the message received by the multi-line receiver by calling the multi-receiver's acknowledge registration and answer lines as described in steps 432 through 440. At step 442 a decision is made as to whether the single-line active messaging party is interested in polling a message from the multi-line receiver. If the polling registration line is called within TP seconds then it is understood that polling is required 446. If on the other hand the polling registration line was not called within TP seconds then polling is not required and the message registration line, in the case of conventional network operations only, is switched to "free" and the receiver is ready for the next message.

Attention is now drawn to Fig. 10 showing the principle steps of a single-line active messaging party logic for transmitting a message code to a multi-

line receiver. At step 500 the active messaging party's identity code (IDC) is encoded (see Fig. 8) and a code messaging procedure is triggered. If, at 502, $MI < OM$, a message can be communicated by calling a single receiver line (i.e., a single code element defines the message). In this case, at step 554, the multi-line receiver's line defining the message, say the n th line is called. If the n th line is "busy" then at step 556 control is transferred to step 558, where the caller disconnects and waits TB secs. before again calling the multi-line receiver's n th line. If the n th line is "free" then at step 560 the caller waits k rings or TR_i secs. before disconnecting. Again, if time measurement is not used then the single-line active messaging party waits for the same time period, say T secs., before disconnecting, independent of which receiver line is called. At step 562 the caller proceeds to the acknowledgement procedure, starting at step 530.

If, at 502, $MI > OM$, a message can only be communicated by calling a number of receiver lines (i.e., a more than one code element defines the message). At step 504 the receiver lines to be called, defining the code elements of the required message code are specified. Preferably, but not necessarily, the first element is the most significant element of the message code and the last element is the least significant element.

At step 506 the "time-out" procedure is initialized and at step 508 the message code element index j is initially set to zero. At step 510 the value of the index j is increased by 1. At step 512 the receiver line corresponding to the j th code element of the message code is dialed. If, at step 514, the dialed line is "busy" then control is transferred to step 516 and the active messaging party disconnects for TB secs. before re-dialing. If on the other hand the dialed line is not "busy" then control is transferred to step 518 and the active messaging party waits either for TR_j secs., or for kj rings before disconnecting. It should be noted that if time measurement is not used then the active messaging party waits for the same time period, say T secs., for each line called before disconnecting.

At step 520 a check is made to see if all the receiver lines defining the message code were successfully dialed, that is if $j = MI$. If so then the full message code was sent to the receiver, step 529, and the process continues from step 530 with message acknowledgement procedures. If the multi-line receiver is

an active messaging party then at step 530 control is transferred to step 531 and the single-line caller waits for appropriate message code acknowledgement (i.e., acknowledge, not acknowledge or partial acknowledge) from the multi-line receiver. If on the other hand, the multi-line receiver is not an active messaging party, then the single-line active messaging party caller has to obtain acknowledgement of the state of the message received by the multi-line receiver by calling the multi-receiver's acknowledge registration and answer lines as described in steps 532 through 550.

10 If at step 520 $j \neq MI$ and "TIME-OUT" has not been reached, 522, then the next line is called (steps 510 to 520 are repeated). If at 522 "TIME-OUT" has been reached, then if at least one line is called, 524, a partial acknowledge message code is prepared, 526. If, on the other hand, no lines were called then the procedure is aborted, 528, and if desired should be restarted.

15 Consideration will now be given to a multi-line active messaging party transmitting a message to a single or multi-line receiver, for intelligent network operations only.

Unlike the former case, where the encoding utilizes the receiver multiple line structure, in this case the encoding is based on the fact that each active messaging party has several calling lines from which a message code can be built. As this case is limited to intelligent network operation, the caller identity code is extracted directly from the call signal. However, since each caller employs many lines, the decoding link between the call and the message code is a multiple step procedure, summarized below.

- 25 (a) extract identity code and message arrival time from the call signal;
- (b) identify the caller to which the calling line belongs;
- (c) identify the value of the specific identity code among the identified caller lines;
- (d) assign an index i to the message code element based on message arrival time and the formerly received ($i-1$) element, if there was a formerly received
- 30 element.

(e) decode the message if all message code elements are available or, partially decode the message code if "*time-out*" terminated the procedure before its completion.

5 Acknowledgement, if needed in this case, is achieved in one of the following ways:

If the receiver is an active messaging party it will send an acknowledge, not acknowledge or partial acknowledge message code to the caller.

10 If the receiver is a passive messaging party having acknowledge registration and answer lines, then the caller will interrogate the receiver for an acknowledge message code.

If the receiver is a passive messaging party not having acknowledge registration and answer lines but the caller is the only messaging source calling the receiver at that time, then the receiver will switch its single line to "*busy*" for *T* seconds if acknowledge or partial acknowledge are the relevant responses or leave it "*free*" if not acknowledge is the relevant response, and the caller will interrogate the receiver immediately upon completion of the messaging procedure for that signal.

20 A flow chart for a multi-line active messaging party transmitting a message to a single-line receiver is given in Figs. 11 and 12, which will now be described. The following notation will be used in these two figures:

TR denotes a ringing period,

i, j indices of message code elements,

TR_j denotes a ringing period for the jth message code element,

25 IDC defined in general as a code specifying in sufficient details the identification of a message source, and with reference to Fig. 11 this means the identity of the caller and the line called from by that caller.

30 Attention is first drawn to Fig. 11 showing the principle steps of the receiver logic of a single-line receiver for receiving a message code from a multi-line active messaging party. At step 600 a call is received from a multi-line active messaging party. The message code to be received is known to be based on KI code elements decoded from caller identity code (IDC) values. At step 602 a call is received and the caller identity and the caller's calling line are identified and the

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ringing period TR is measured. Again it is emphasized that measurement of the ringing period is optional and when used adds an additional degree of freedom in building the message code.

When the first call of a given caller is received then the decoding session will not be "ON" and at step 604 control is transferred to step 606 and the "time-out" procedure is initialized for the current caller, whereby the decoding session for the current caller is declared "ON". At step 608 the first code element of the message code is taken to be a number related to the caller identity and the line called from by that caller, and the index i is set equal to 1. At step 610 a check is made to see if the message code to be received is based on 1 code element (KI = 1). If the message code to be received is based on 1 code element then at step 612 the message code is ready for precise decoding generating an identified message and a message arrival time.

If the receiver is an active messaging party, then at step 614 control is transferred to step 616 and the receiver will send an appropriate acknowledgement message code to the caller which will be one of, acknowledge, not acknowledge or partial acknowledge message codes. Control is then transferred to step 618 where the receiver waits for the next call. If, however, the receiver is not an active messaging party then at step 614 control is transferred to step 620 and the receiver waits for an acknowledge message code interrogation by the caller. The receiver, of course, prepares an appropriate acknowledge message code for the caller on its registration lines. Clearly then, if the receiver is not an active messaging party, and the caller has to receive an acknowledge message code, then the receiver cannot be a single line receiver. Following step 620 control is transferred to step 618 and at step 622 "TIME-OUT" is checked for the current decoding sessions. If "TIME-OUT" has not been reached then control is returned to step 600.

If at step 622 "TIME-OUT" is reached then at step 624 a check is made to see if, for the current caller, message code elements have been received or not. If no message code elements have been received for the current caller then at step 626 the message receiving procedure is aborted for that caller and control is transferred to step 614 for relaying a not-acknowledge message code to the caller. If some, but not all, message codes have been received from the current caller then

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the caller's message code can be partially decode, 628, after which control is transferred to step 614 for relaying a partial-acknowledge message code to the caller. Following this control is transferred to step 618 and then on to step 622.

5 If at step 604 a decoding session is "ON" for the current caller then control is transferred to step 630 and the index i of the former decoded element of the current caller is checked and then at step 632 j is defined as $1+i$. At step 634 the j th code element is related through a data-base code conversion table to the caller identity and the line called from by that caller.

10 At step 636 a check is made if all the code elements have been received. If all the code elements have been received then at step 612 the received message code is ready for decoding after which acknowledgement through steps 614 to 620 is performed, as described above.

15 Attention is now drawn to Fig. 12 showing the principle steps of a multi-line active messaging party logic for transmitting a message code to a single-line receiver. At step 700 a multi-line active messaging party generates a message code transmission utilizing intelligent network operations. At step 702 a message code using KI elements is encoded. Each code element is represented by one of the caller's line numbers accompanied by the call ringing period, TR. Preferably, but not necessarily the message code is built with the first code element being the most significant message element, and the last code element (the KIth) being the least significant message element.

20 At step 704 the "time-out" procedure is initiated. At step 706 the index i is set to zero. At step 708 the value of the index i is increased by 1. At step 710 check it made to see if "time-out" has been reached. If "time-out" has not been reached then at step 712 then the multi-line active messaging party calls the receiver from the line assigned to the i th code element. At step 714 the state of the receiver line is checked. If it is "busy" then at step 722 the caller disconnects and waits for TB secs. before returning to step 712. If on the other hand the receiver line is not "busy" then the caller waits TR i secs. before disconnecting, 716. At 30 step 718 the code element index is checked. If the KIth element has been sent, then the complete message code has been sent, 720, and the process continues with the acknowledge/polling procedures, steps 730, 732 and 734. If at step 718 the

If the element has not yet been sent then control is transferred to step 708 and the process continues.

If at step 710 "time-out" is reached then the number of code elements transmitted is checked at step 724. If no code elements have been transmitted then at step 724 the procedure is aborted, 726, and will have to be restarted at step 702. If, however, at least one element has been transmitted then the message has been partially sent, 728, and at step 729 the partially sent message is checked to see if it is sufficient or not. If the partial message sent is considered not sufficient then the procedure is aborted, 726. If the partial message sent is considered sufficient then the process continues with the acknowledge/polling procedures, steps 730, 732 and 734.

Figs. 9 to 12 also cover the special case of a single-line caller calling a single-line recipient, with Figs. 10 and 12 covering the special case of a single-line active messaging party transmitting a message to a single-line receiver and Figs. 9 and 11 covering the special case of a single-line recipient receiving a message from a single-line active messaging party. These special cases are for intelligent network operation only.

Unlike the more general cases of messaging between multi-line and single-line communicating parties, where the encoding and decoding are based on the calling or called line numbers together with the order of the unanswered calls, in this special case of messaging between single-line communicating parties the message code element is based on a period of time elapsed from a clock trigger of the receiver until disconnection of the "ringing" process. As this special case is limited to intelligent network operation, or to communication between two and only two well defined parties, the caller identity code is directly extracted from the call. However, since each message code can be based on many elements, the decoding link between the call and the message code is a multi-step procedure, summarized below:

- (a) extract caller identity code and message time of arrival from the call;
- (b) measure the time from first "ring" till the end of the ringing process;
- (c) divide the measured time by a decoding parameter TD and extract from the result the element message code value by rounding off the result of the division

to the nearest message code element value (for example, suppose that the time from a clock trigger till last ring is 7.5 sec and that $TD=4$ sec. Assuming that the available message code elements are 1,2,4,6,8, then the message code element value extracted in this case is 2.);

- 5 (d) assign an index i to the message code element, based on message arrival time and the previously received message code element (i.e., the $(i-1)$ th element), if relevant;

- (e) decode the message, if all message code elements are available, knowing the number of elements building the message code, or partially decode the message code if "time-out" interrupted the procedure; and
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 (f) if the receiver is a passive messaging party - generate an acknowledge code (as a "busy" signal) for a predefined period of time after receiving the last code element, or a not acknowledge code (as a "free" signal) whenever relevant; or

- 15 (g) if the receiver is an active messaging party - call the sender for a connection time free transmittal of an acknowledge message code or a not acknowledge message code by generating a "busy" signal or a "free" signal as in step (f).

- In accordance with the decoding procedure described above, the
- 20 encoding of the connection free time message by the sender is conducted as follows:

- (i) select the message code from the data-base per the event to be reported, (where each code element is has two parameters, the first a number to be called, and the second the time from a clock trigger till disconnection;
- 25 (ii) call the receiver number of the first code element (the most significant element) and wait in a "ringing" mode for a period of time as defined by the specific code element;
- (iii) disconnect the call;
- (iv) repeat steps (ii) and (iii) serially for all the remaining code elements; and
- 30 (v) upon completion of the transfer of the coded message, proceed to acknowledgment as specified in steps (f) or (g).

Consideration will now be given to a single line active messaging party interrogating a multi-line passive messaging party's message through polling. The multi-line passive messaging party is capable of responding to many active messaging parties, but only one at a time.

5 For intelligent network operations the first stage of data polling from a passive messaging party is calling the passive messaging party's polling registration line, which serves the purpose of identifying the caller to the passive messaging party which accordingly prepares a message code relevant to the specific caller. At the same time access to the passive messaging party is blocked to other
10 con-current callers for data polling by switching the polling line to "*busy*". If there is a message waiting for the current caller, then the answer line is switched to "*busy*", thereby indicating to the interrogating caller that a message is waiting. If no message is waiting then the procedure will be terminated for both the active messaging party and the passive messaging party.

15 The message encoding is generated as a binary code utilizing "*busy*" and "*free*" states of the incoming N lines of the passive messaging party. In cases where N is too small to allow encoding of a full binary message code, then a number of successive cycles are utilized where the more significant bits are encoded in the first cycle (the first line called is the most significant bit) and the least
20 significant bits are encoded at the last cycle (the last line called is the least significant bit). In such cases the active messaging party will signal to the passive messaging party that a cycle has been read in full by calling the acknowledge registration line, and the passive messaging party will, in response, encode the next cycle of N lines. When the procedure is completed or terminated due to "*time-*
25 *out*", all the receiver lines are switched to "*free*" to allow for the next messaging procedure to start.

 The only difference between intelligent network operation and conventional network operation is that the conventional network procedure must start with caller identification encoding by the active messaging party before the
30 receiver is able to encode the message code. Whereas for intelligent network operation the caller identification is modulated on the carrier frequency of the communication signal transmitted through the telephone network, usually between

the first and second incoming rings, and is directly extracted by a modem or line interface connected to the receiver line called by the caller.

The procedure for polling a message code from a multi-line receiver by a single-line caller is described in Figs. 13 and 14, which will be described in
5 below.

Attention is first drawn to Fig. 13 showing the principle steps of a multi-line receiver logic for message code polling by a single-line caller (active messaging party). At step 800 the passive messaging party's polling registration line is called and the caller is identified. At step 802 access to the multi-line
10 receiver is blocked to other con-current callers by switching the polling line to "busy". If there is a message waiting for the current caller, 804, then the answer line is switched to "busy", 806, for T secs., thereby indicating to the interrogating caller that a message is waiting.

If, at step 808, the active messaging party calls the receiver's answer-
15 line within T secs. then at step 810 the "time-out" procedure is initiated. If at step 804 no message is waiting for the current caller then the caller waits for T secs. and control is transferred to step 836. Similarly, if the active messaging party does not call the receiver's answer-line within T secs. at step 808 then control is also transferred to step 836. At step 836 the polling procedure is terminated and all the
20 receiver lines including the polling and message code registration lines are set to "free". The polling procedure has to be restarted and is open to all callers.

As pointed out above message encoding is generated as a binary code utilizing "busy" and "free" states of the incoming N lines of the passive messaging party. Initially, all the incoming N lines are set to "free". At step 812 a check is
25 made to see if number of code elements K (binary bits) comprising the message code is greater or less than N. If $K < N$ then the number of lines is large enough to allow encoding and at step 840 the required message code is built by switching L of the N lines to "busy". At step 838 a check is made for "time-out". If "time-out" is reached then the procedure is terminated at step 836. If "time-out" is not
30 reached then a check is made, 834, to see if the caller has called the receiver's acknowledge-registration line, indicating that the message has been successfully polled.

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If at step 812 it is found that $K > N$, then the N lines are not sufficient to allow encoding of a full binary message code. In this case the message code is divided into a number of successive cycles. The quantity $[K/N] + 1$, where $[x]$ denotes the integer value of x , determined at step 814 is the number of successive cycles required.

The loop given by the steps 818 to 832 describes the encoding of the message code in J cycles, at step 820, with preset scan time allowing the caller enough time to call the incoming receiver lines and an acknowledgement each cycle that the message code of that cycle has been read, at step 832. Again, when the procedure is completed or terminated due to "time-out", all the receiver lines are switched to "free" to allow for the next messaging procedure to start, at step 836.

Attention is now drawn to Fig. 14 showing the principle steps of a single-line caller logic for message code polling from a multi-line receiver. At step 900 a trigger for a single-line active messaging party polling a message from a multi-line receiver is set on. At steps 902 to 906 the receiver's polling registration line is called until it "free". At step 908 the caller waits T_1 secs. and then disconnects and then at step 910 calls the receiver's answer-registration line. At step 912 the state of the receiver's answer-registration line is checked. If the line is "free" then there is no message waiting for the caller and at step 914 the procedure is terminated. If the line is "busy" then there is a message waiting for the caller, 916, and the "time-out" procedure is initiated at step 918.

At step 920 the maximum number of code elements, K , is compared with the number of receiver incoming lines, N . If $K < N$ then the number of incoming receiver lines is large enough to hold the complete message code and control is transferred to step 922 where the line index i is set equal to zero and the polling process for a one cycle polling procedure begins. In the loop defined by steps 924 to 936 the message code is polled line-by-line as follows. First the line index, i , is set to 1, then the i th line of the receiver is called, 926, and a check is made for the state of the line, 928, if it is "free", 930, the caller waits for T_2 secs. and then disconnects, whereas if the line is "busy", 932, the caller waits for T_3 secs. and then disconnects. Following disconnection a check is made to see if the last coded line has been called, 934. If the last coded line has not been called

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then a check for "TIME-OUT" is made, 936. If "TIME-OUT" has not been reached, then control is returned to step 924 and the next coded line is called. If "TIME-OUT" has been reached, then the message code has only partially been polled and a partial acknowledge message code is prepared by the caller, 938. If, on the other hand, at step 934, the last coded line has been called then the message code has been fully polled and the caller appropriately acknowledges the successful completion of the polling procedure in steps 940 to 948.

If at step 920 it is found that $K > N$, then the N receiver lines are not sufficient to hold the complete message code. In this case the message code is divided into a number of successive cycles where J defines the number of cycles required to poll the message code. Steps 956 to 980, are identical to the steps 924 to 946 for polling a message in one cycle. However, to steps 956 to 980, are added steps 950 to 954 and steps 982 and 983 which cause the single cycle polling procedure to be repeated J times.

The present invention has been described and illustrated with a certain degree of particularity. However, it should be understood that various alterations and modifications may be made without departing from the spirit or scope of the invention as hereinafter claimed.

Attention is now drawn to Figs. 15 and 16 which illustrate an example of one line which serves for transmittal of messages between sender and receiver whilst utilizing the CEIC approach of the invention, i.e. an LSP that constitutes a code element that is attached to the IDC value and as explained before, this is only one out of many possible variants according to the invention.

Figs. 15 and 16 are essentially identical to Figs. 11 and 12 with minor modifications. The blocks which are subject to modifications are designated in the same reference numerals as the counterpart block in Figs. 11 and 12 with the addition of an apostrophe. The remaining blocks are identical and therefore will not be further explained herein. Turning at first to Fig. 16, a transmittal sequence is shown where in block 700' the code elements consist now of MSP and LSP constituent as well as code elements relating to ringing time. In block 702' MSC is encoded using K_i elements. Each element represented by an LSP value appended to the sender's single MSP number in the sender IDC that is transmitted over the

network. The entire process continues as described in Fig. 12 with the exception that if time out has not been expired (block 712') the EIC code element (MSP and LSP) is transmitted to the receiver.

Turning now to Fig. 15 which resembles Fig. 11, the procedure of receiving the combined MSP and LSP is described in block 600': In block 634' the MSC element i is determined according to the so obtained code element LSP_i and the code element TR_i (assuming that the session is on). In the case that the session has just commenced, the so extracted LSP_i and TR_i constitute the first LSP and ringing time elements, respectively, and the *time out* counting for the session is triggered. It is, of course, not required that every call will include both LSP and T_i ringing period constituents, but for the sake of clarity, consider the following example, where only LSP and ringing period code element are regarded.

In the first ring LSP_1 code element and T_1 code element are obtained. In the second ring LSP_2 code element and T_2 code element are obtained and in the third ring LSP_3 code element and T_3 code element are obtained (T_1 , T_2 and T_3 are not necessary unique and the same applies for LSP_1 , LSP_2 and LSP_3).

The three LSPs code elements form part of a code portion and likewise the three ringing periods form part of a code portion of a code that corresponds to a given message (from a set of messages) that may be extracted by utilizing e.g. LUT). As explained above, the order which the code elements are encoded may, if desired, be significant for determining the corresponding message. Thus, by way of a non-limiting example, the sequence: $LSP_1 T_1$ in the first call; $LSP_2 T_2$ in the second call represents a different message than the sequence $LSP_2 T_2$ in the first call; $LSP_1 T_1$ in the second call.

If desired, other parameters such as caller telephone line, receiver telephone line may also be used to further increase the number of combinations which obviously increase the repertoire of messages.

It is important to note that the same combination may correspond to different messages for respective callers (or recipients). Thus, by way of non-limiting example, $LSP_1 T_1$ for one recipient corresponds to a first message whereas the same combination $LSP_1 T_1$ for a different recipient corresponds to a second message.

CLAIMS:

1. A method for communicating between a caller and a recipient via telephone networks comprising the steps of:
 - 5 (a) the caller placing at least one call from at least one caller telephone line to at least one recipient telephone line;
 - (b) the recipient receiving but not answering the at least one call, whereby a code is communicated between the caller and the recipient; and
 - (c) determining a message from the communicated code.
- 10 2. The method according to Claim 1, wherein the code is communicated by the recipient noting which recipient telephone lines are called and if more than one line is called in which order they are called.
3. The method according to Claim 1, wherein the code is communicated by the recipient noting from which caller telephone lines the at least one call is
15 made and if more than one call is made in which order the calls are made.
4. The method according to Claim 1, further comprising the step of the recipient preparing at least one recipient telephone line in a given state and wherein the code is communicated by the caller noting the state of the at least one recipient telephone line.
- 20 5. The method according to Claim 4, wherein the given state of a recipient telephone line is chosen from amongst the group that includes busy and free states.
6. The method according to Claim 1, wherein the call is received at a first time value and wherein the code is communicated by the recipient noting which recipient telephone lines are called together with the elapsed time between the first
25 time value and disconnection.
7. The method according to Claim 1, wherein the call is received at a first time value and wherein the code is communicated by the recipient noting from which caller telephone lines the at least one call is made together with the elapsed time between the first time value and disconnection.
- 30 8. The method according to Claim 6, wherein the first time value is the time at which a clock trigger of the call occurred.



9. The method according to Claim 1, wherein the telephone networks are intelligent networks.
10. The method according to Claim 1, wherein the telephone networks are conventional networks.
- 5 11. The method according to Claim 9, further comprising the network providing a caller identity code which is automatically transmitted on communication signals transmitted through the telephone networks when the caller places a call, and which is capable of being automatically decoded from the communication signals.
- 10 12. The method according to Claim 10, further comprising the caller providing caller identification being provided by the caller calling recipient telephone lines indicative of the caller identity code.
13. A method for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, the method comprising the following
- 15 steps:
- placing at least one telephone call by a caller, whereby at least one telephone line is called;
- receiving at least one telephone call without answering the call by a recipient;
- and
- 20 relating the at least one call of the caller to recipient called but not answered telephone number to a given code; the code being indicative of an identified message.
14. A method for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, the method comprising the steps of:
- 25 placing at least one telephone call by a caller, whereby at least one telephone number is transmitted;
- receiving at least one telephone number by a recipient in response to the transmitted at least one telephone number, without answering the placed at least one telephone call; and
- 30 relating the received at least one caller telephone number to a given code; the code being indicative of an identified message.



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15. A method for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, and wherein a telephone line state determines authorization for continuation of the method for communicating, authorization being given if the telephone line state is in an "authorization-continue" state; the method comprising the steps of:
- 5 placing at least one unanswered telephone call by an active caller to at least one passive caller telephone line and upon receiving "authorization-continue" state; placing a series of at least one unanswered telephone call by the active caller to the at least one passive caller line; and
- 10 noting the telephone line states of the series of at least one unanswered telephone call, whereby a series of states indicative of a message code is obtained, the code being indicative of an identified message.
16. A method for communicating that exploits existing telephone networks, wherein telephone call are placed but not answered, and wherein the time from a first time value till disconnection of the call together with the called line number generates a code-element of a coded message; the method comprising the steps of:
- 15 placing at least one telephone call by a caller, whereby at least one telephone line is called but not answered;
- receiving at least one telephone call without answering the call by a recipient;
- 20 and noting the time from the first time value till disconnection of the call; and relating the at least one call of the caller to recipient called but not answered telephone number together with the time noted from the first time value till disconnection to a given code; the code being indicative of an identified message.
17. A method for communicating that utilizes telephone networks, wherein telephone call are placed but not answered, and wherein the time from a first time value till disconnection of the call together with the calling line number generate a code-element of a coded message; the method comprising the steps of:
- 25 placing at least one telephone call by a caller, whereby at least one telephone line is called;
- 30 receiving at least one telephone number by a recipient in response to the transmitted at least one telephone number, without answering the placed at least one



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telephone call; and noting the time from the first time value till disconnection of the call; and

relating the received at least one caller telephone number together with the time noted from the first time value till disconnection to a given code; the code
5 being indicative of an identified message.

18. The method according to Claim 16, wherein the first time value is the time at which a clock trigger of the call occurred.

19. A system for communicating between a caller and a recipient via telephone networks comprising:

10 (a) means for the caller placing at least one call from at least one caller telephone line to at least one recipient telephone line;

(b) means for the recipient receiving but not answering the at least one call, whereby a code is communicated between the caller and the recipient; and

(c) means for determining a message from the communicated code.

15 20. The system according to Claim 19, wherein the code is communicated by the recipient noting which recipient telephone lines are called and if more than one line is called in which order they are called.

21. The system according to Claim 19, wherein the code is communicated by the recipient noting from which caller telephone lines the at least one call is
20 made and if more than one call is made in which order the calls are made.

22. The system according to Claim 19, further comprising the step of the recipient preparing at least one recipient telephone line in a given state and wherein the code is communicated by the caller noting the state of the at least one recipient telephone line.

25 23. The system according to Claim 22, wherein the given state of a recipient telephone line is chosen from amongst the group that includes busy and free states.

24. The system according to Claim 19, wherein the call is received at a first time value and wherein the code is communicated by the recipient noting which
30 recipient telephone lines are called together with the elapsed time between the first time value and disconnection.



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25. The system according to Claim 19, wherein the call is received at a first time value and wherein the code is communicated by the recipient noting from which caller telephone lines the at least one call is made together with the elapsed time between the first time value and disconnection.
- 5 26. The system according to Claim 24, wherein the first time value is the time at which a clock trigger of the call occurred.
27. The system according to Claim 19, wherein the telephone networks are intelligent networks.
28. The system according to Claim 19, wherein the telephone networks are
10 conventional networks.
29. The system according to Claim 27, further comprising the network providing an identity code which is automatically transmitted on communication signals transmitted through the telephone networks when the caller places a call, and which is capable of being automatically decoded from the communication
15 signals.
30. The system according to Claim 28, further comprising the caller providing caller identification being provided by the caller calling recipient telephone lines indicative of the caller identity code.
31. A system for communicating that utilizes telephone networks, wherein
20 telephone calls are placed but not answered, the system comprising:
- means for placing at least one telephone call by a caller, whereby at least one telephone line is called;
- means for receiving at least one telephone call without answering the call by a recipient; and
- 25 means for relating the at least one call of the caller to recipient called but not answered telephone number to a given code; the code being indicative of an identified message.
32. A system for communicating that utilizes telephone networks, wherein telephone calls are placed but not answered, the system comprising:
- 30 means for placing at least one telephone call by a caller, whereby at least one telephone number is transmitted;



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means for receiving at least one telephone number by a recipient in response to the transmitted at least one telephone number, without answering the placed at least one telephone call; and

means for relating the received at least one caller telephone number to a given
5 code; the code being indicative of an identified message.

33. A system for communicating that utilizes telephone networks, wherein telephone calls are placed but not answered, and wherein a telephone line state determines authorization for continuation of communicating, authorization being given if the telephone line state is in an "authorization-continue" state; the system
10 comprising:

means for placing at least one unanswered telephone call by an active caller to at least one passive caller telephone line and upon receiving "authorization--continue" state;

means for placing a series of at least one unanswered telephone call by the
15 active caller to the at least one passive caller line; and

means for noting the telephone line states of the series of at least one unanswered telephone call, whereby a series of states indicative of a message code is obtained, the code being indicative of an identified message.

34. A system for communicating that exploits existing telephone networks,
20 wherein telephone calls are placed but not answered, and wherein the time from a first time value till disconnection of the call together with the called line number generates a code-element of a coded message; the system comprising:

means for placing at least one telephone call by a caller, whereby at least one telephone line is called but not answered;

25 means for receiving at least one telephone call without answering the call by a recipient; and noting the time from the first time value till disconnection of the call; and

means for relating the at least one call of the caller to recipient called but not answered telephone number together with the time noted from the first time value
30 till disconnection to a given code; the code being indicative of an identified message.



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35. A system for communicating that utilizes telephone networks, wherein telephone calls are placed but not answered, and wherein the time from a first time value till disconnection of the call together with the calling line number generate a code-element of a coded message; the system comprising:

5 means for placing at least one telephone call by a caller, whereby at least one telephone line is called;

means for receiving at least one telephone number by a recipient in response to the transmitted at least one telephone number, without answering the placed at least one telephone call; and noting the time from the first time value till
10 disconnection of the call; and

means for relating the received at least one caller telephone number together with the time noted from the first time value till disconnection to a given code; the code being indicative of an identified message.

36. The system according to Claim 34, wherein the first time value is the
15 time at which a clock trigger of the call occurred.

37. For use in a system in accordance with Claim 19, an active messaging party for transmitting message codes.

38. For use in a system in accordance with Claim 19, a passive messaging party for receiving message codes and for preparing message codes for polling.

20 39. For use in a system in accordance with Claim 19, a device requiring status reports of at least one state thereof.

40. For use in a system in accordance with Claim 19, an automated point of service requiring status reports selected from at least one of the type and quantity of stock and service required for the automated point of service and faults and
25 failures of the automated point of service that are required to be fixed.

41. For use in a system in accordance with Claim 19, a manned point of service requiring status reports selected from at least one of the type and quantity of stock and service required for the manned point of service and faults and failures of the manned point of service that are required to be fixed.

30 42. For use in a system in accordance with Claim 19, a utility meter requiring status reports of values read from the utility meter.



43. For use in a system in accordance with Claim 19, a device command for applying to a device having a given state, the device command causing a change in the given state.

44. For use in a system in accordance with Claim 19, a controller command
5 for applying to an apparatus having a given state, the controller command causing a change in the given state and the apparatus being selected from at least one of a group that includes water valves, traffic lights, electric current switches and smart house controllers.

45. A method for sending an encoded message, selected from a set of at
10 least one message, from at least one telephone line of a calling end to at least one telephone line of receiving end in an intelligent telephone network, comprising:

(a) at the calling end, encoding the message so as to include at least a code portion which is transparent to the intelligent telephone network;

(b) routing the encoded message via at least one call from at least one of said
15 telephone line of the calling end to at least one of said telephone line of the receiving end;

(c) at the receiving end, receiving but not answering the at least one call and decoding therefrom the encoded message.

46. The method according to Claim 45, wherein said code portion that is
20 stipulated in step (a) is consisting of at least one code element being a Least Significant Portion (LSP) attached to an extended identification code section of a call from among said at least one calls.

47. The method according to Claim 46, wherein an LSP of respective
25 element is attached to either the caller extended identification code (CEIC) or to the receiver extension identification code (REIC).

48. The method according to Claim 45, wherein said encoding the message as stipulated in said step (a) further includes code portion that is consisting of at least one element being an elapsed time set between first time value to disconnection of a call from among said at least one calls.

30 49. The method according to Claim 45, wherein the encoding the message as stipulated in said step (a), further includes code portion that is consisting of at



least one code element being a telephone line from among said at least one calling telephone lines.

50. The method according to Claim 45, wherein the encoding the message as stipulated in said step (a), further includes code portion that is consisting of at least one code element being a telephone line from among said at least one receiving telephone lines.

51. The method according to Claim 45, wherein the encoding of message as stipulated in said step (a) being order sensitive.

52. The method according to Claim 45, wherein the encoding of message as stipulated in said step (a) being order insensitive.

53. The method according to Claim 45, wherein the message that is subject to encoding in said step (a), is dependent upon said receiver.

54. A system for sending an encoded message, selected from a set of at least one message, from at least one telephone line of a calling end to at least one telephone line of receiving end in an intelligent telephone network, comprising:

(a) at the calling end, encoder for encoding the message so as to include at least a code portion which is transparent to the intelligent telephone network;

(b) router for routing the encoded message via at least one call from at least one of said telephone line of the calling end to at least one of said telephone line of the receiving end;

(c) at the receiving end, receiver for receiving but not answering the at least one call and decoding therefrom the encoded message.

55. The system of Claim 54, wherein said code portion that is stipulated in (a) is consisting of at least one code element being a Least Significant Portion (LSP) attached to an extended identification code section of a call from among said at least one calls.

56. The system according to Claim 55, wherein an LSP of respective element is attached to either the caller extended identification code (CEIC) or to the receiver extension identification code (REIC).

57. The system according to Claim 54, wherein said encoding the message as stipulated in (a) further includes code portion that is consisting of at least one



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element being an elapsed time set between first time value to disconnection of a call from among said at least one calls.

58. The system according to Claim 54, wherein the encoding the message as stipulated in (a), further includes code portion that is consisting of at least one
5 code element being a telephone line from among said at least one calling telephone lines.

59. The system according to Claim 54, wherein the encoding the message as stipulated in (a), further includes code portion that is consisting of at least one
10 code element being a telephone line from among said at least one receiving telephone lines...

60. The system according to Claim 54, wherein the encoding of message as stipulated in (a) being order sensitive.

61. The system according to Claim 54, wherein the encoding of message as stipulated in (a) being order insensitive.

15 62. The system according to Claim 54, wherein the message that is subject to encoding in (a), is dependent upon said receiver.

63. For use in a system according to Claim 54,
at the calling end, encoder for encoding the message so as to include
at least a code portion which is transparent to the intelligent telephone network;
20 router for routing the encoded message via at least one call from at least one of said telephone line of the calling end to at least one of said telephone line of the receiving end.

64. For use in a system according to Claim 54,
at the receiving end, receiver for receiving but not answering the at
25 least one call and decoding therefrom the encoded message.

65. A system according to Claim 19, utilizing a cost-related message.

66. A system according to Claim 31, utilizing a cost-related message.

67. A system according to Claim 32, utilizing a cost-related message.

68. A system according to Claim 33, utilizing a cost-related message.

30 69. A system according to Claim 34, utilizing a cost-related message.

70. A system according to Claim 35, utilizing a cost-related message.

71. A system according to Claim 45, utilizing a cost-related message.



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72. A system according to Claim 54, utilizing a cost-related message.



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